The Cloud Chamber

A cloud chamber is a device that makes visible the paths of particles emitted as a result of radioactive decay. When subatomic particles enter the cloud chamber they bump into air or alcohol molecules producing free ions. The ions serve as a starting point for the growth of visible droplets in the space that contains more condensed vapor than usual. The droplets form the visible trails. The cloud chamber provides a supersaturated atmosphere in which this is possible.

In the diffusion cloud chamber a large difference in temperature is maintained between the top and the bottom of the chamber, usually by cooling the bottom with dry ice. The gas in the chamber, in this case air, is saturated with a vapor, usually alcohol. The air-vapor mixture cools as it diffuses to the frigid bottom, creating a supersaturated environment, the cloud.

Cosmic rays are penetrating radiation that comes from outside the earth. They are at least ten times as penetrating as the most energetic gamma rays known. Cosmic ray showers can be detected by the cloud chamber. They enter the chamber in countless tracks. A shower originates from the interaction of high-energy particles with atoms in the air near the chamber, atoms in the wall of the chamber itself, or even from the walls of the room in which the cloud chamber is placed.

Cosmic rays in the cloud chamber have some distinctive characteristics. As a cosmic ray passes through the chamber they produce thin, misty trails. Most of these trails are bent and crooked. Low-energy cosmic rays often produce jagged or curly paths as they travel through the chamber. Using the cloud chamber it is possible to find some general characteristics about cosmic rays. Here are a few things to try:

1. Do cosmic rays appear to be coming from any particular direction (vertical, horizontal)?

2. Use the sources(α,β). Observe how each of the sources produces different types of tracks (length, path, thickness).
3. Using your observations from before, can you characterize what types of particles make up cosmic rays?

4. Do cosmic rays appear single or in clumps? Why might this be the case?

5. Why are some cosmic ray paths long and straight and others more jagged or even curled?